

NISTTech

Oxygen-Containing Compounds as Boundary Lubricants for Silicon Nitride Ceramics

Method for lubricating advanced ceramics under high stress and high load conditions

Description

A method for lubricating silicon nitride ceramics under high stress and high load conditions using oxygen-containing compounds, particularly compounds wherein the oxygen is present in OH-groups, such as alcohols, sulfonic and carboxylic acids, or metal salts thereof.

Advanced ceramics offer great potential for future engineering applications. Their unique blend of strength, wear and corrosion resistance and light weight enables technologies that were not possible otherwise. Technologies such as low heat rejection engines, advanced gas turbines, environmentally compatible fuel efficient diesel engines, and space structures all depend on the availability of such advanced materials. The brittleness of ceramics, however, causes concern in terms of reliability and durability, especially since effective reliable lubrication technology of ceramics does not currently exist. This limits the load carrying capacity of the ceramics and durability of the ceramic component.

Silicon nitride, e.g., Si_3N_4 , is the most promising ceramic for future applications in bearings, tools and engine components. The ability to lubricate these materials under high stress (boundary) conditions will become critical as the technology continues to mature.

Applications

- **Ceramics development**
This lubricant allows researchers to push the limits of ceramics strength tests because they can now be well lubricated even in high stress (boundary) conditions.

Advantages

- **Environmentally friendly (green technology)**
Achieves boundary lubrication for silicon nitride without using phosphorous-containing compounds.
- **Small amount of lubricant, drastic reduction in friction**
Adding just 1.0% of OH-group alcohol compounds to a base oil can

reduced wear by over 90%.

- **Creates a boundary film**

When applied to ceramic, the OH-group alcohols create a better, alternative type of boundary film.

Abstract

Oxygen-containing compounds, particularly compounds wherein the oxygen is present in OH-groups, such as alcohols, sulfonic and carboxylic acids, or metal salts thereof, serve as lubricants for ceramic materials, particularly silicon nitride materials under high stress and high load conditions.

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Citations

1. 1.) Silicon Nitride Boundary Lubrication: Effect of Oxygenates. Richard S. Gates; Stephen M. Hsu. Tribology Transactions, Volume 38, Issue 3 July 1995 , pages 607 - 617.

References

- Expired Patent # 6,207,627
- Docket: 92-036US

Status of Availability

This technology is available in the public domain.

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